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## A FEW COMMENTS...

1. Congratulations for  
an appearance result
2. The SNO-SK connection  
Congratulations to Villante for  
response functions properties
3. Congratulation to SSM:  
 $\varphi_{ACT}(B) = \varphi_{SSM}(B)$   
(So what?)
4. Congratulations to Clevernick  
(no cloud on Davis result)

L2

CONGRATULATIONS FOR APPEARANCE  
RESULT

① Before SNO only disappearance ex.

$$Cl_{exp} < Cl_{SSM}$$

$$Ga_{exp} < Ga_{SSM}$$

$$SKam_{exp} < SKam_{SSM}$$

② After SNO for the first Time  
we have in SKa signal which is larger  
than that of  $\nu_e$  observed by SNO

$SKam_{exp} >$  expectation on  
 $\nu_e$  as measured  
by SNO

③ FINALLY WE HAVE A POSITIVE  
SIGNAL (FROM A COMB. OF 2 EXPTS)

# The SNO-SR Connection

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Solar neutrino interactions: Using charged currents at SNO  
to tell neutral currents at Super-Kamiokande

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## Abstract

In the presence of flavor oscillations, muon and tau neutrinos can contribute to the Super-Kamiokande (SK) solar neutrino signal through the neutral current process  $\nu_{\mu,\tau} e^- \rightarrow \nu_{\mu,\tau} e^-$ . We show how to separate the  $\nu_e$  and  $\nu_{\mu,\tau}$  event rates in SK in a model independent way, by using the rate of the charged current process  $\nu_e d \rightarrow p p e^-$  from the Sudbury Neutrino Observatory (SNO) experiment, with an appropriate choice of the SK and SNO energy thresholds. Under the additional hypothesis of no oscillations into sterile states, we also show how to determine the absolute  $^8B$  neutrino flux from the same data set, independently of the  $\nu_e$  survival probability.

PACS: 26.65+t, 13.15+g, 14.60.Pq

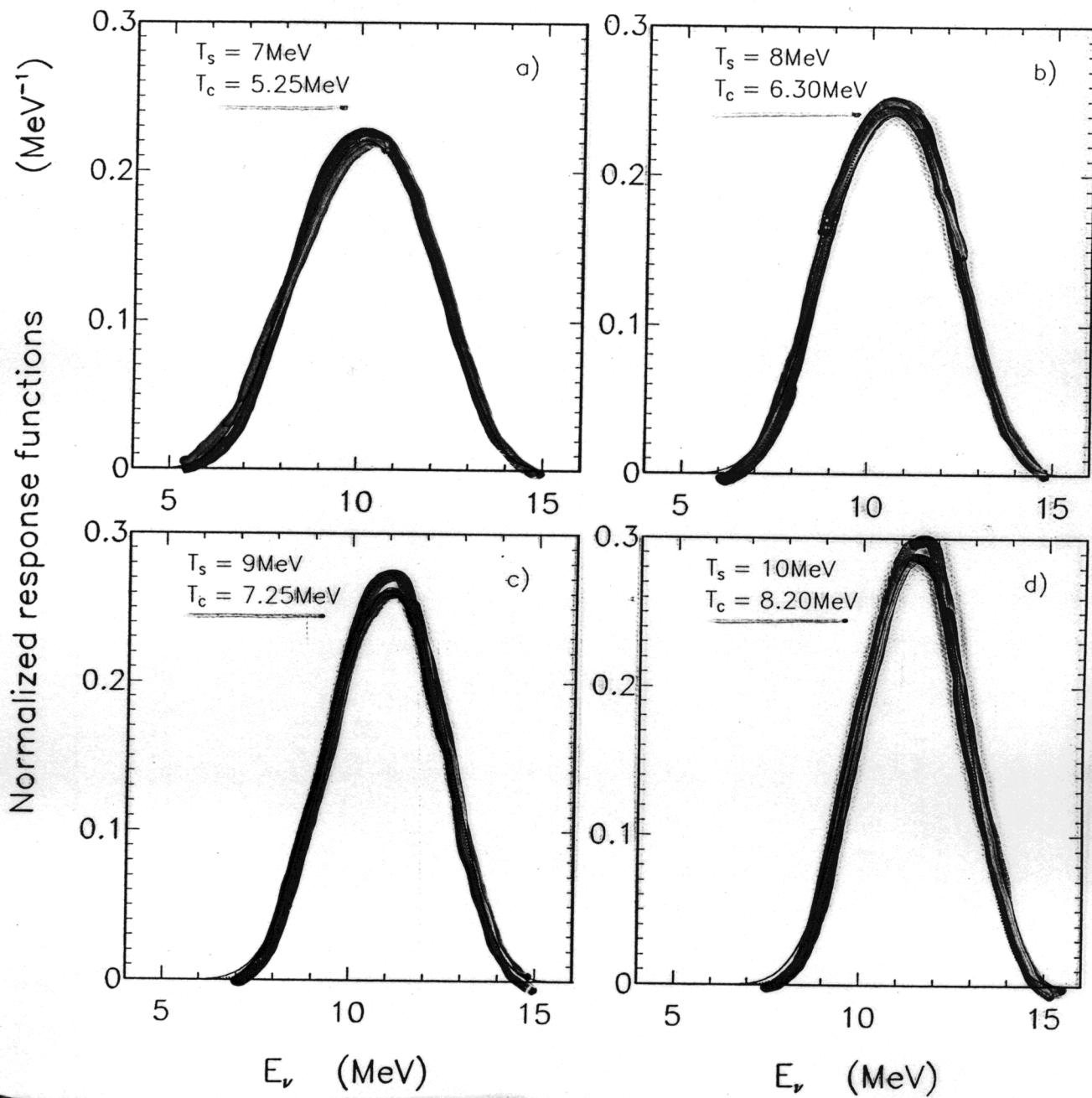
Phys. Rev. D59 (1999) D13006

- Extraction of SK neutral current from SNO cc is trivial if  $P_{ee}$  is independent of energy\*
- Extraction is still possible also if  $P_{ee}$  depends on energy\*  
\*in the Boron region

Typeset using REVTEX

# How to equalize SK and SNO response functions?

— SK  
 — SNO



MAGIC SHIFT:

$$T_{SNO} \approx T_{SK} - 1.7 \text{ MeV}$$

WISH:

AN ANALYSIS BY  
EXPERIMENTALISTS  
THEMSELVES

FLV, G. FIORENTINI, E. LISI  
Phys. Rev. D 59 (1999) 013006

## THE ACCURACY OF SSM

- SNO + SK imply:

$$\varphi(B) = \varphi(B) \left(1 \pm \Delta\right)$$

ACT                    SSM

with an accuracy  $\Delta \approx 20\%$ .

- CONFIRMATION OF A DELICATE PREDICTION OF SSM. In fact the prediction depends on:

- nuclear physics

$$\varphi(B) \propto \frac{S_{34} S_{17}}{\sqrt{S_{33}}}$$

- solar physics

(opacity, metals....)

$$\varphi(B) \propto T_c^{\alpha} \quad \alpha \approx 2.5$$

strong dependence of the central solar temperature

16

Desperate attempts in the last 30 years to reduce prediction of  $\varphi(B)$  resulted in:

a) better nuclear physics theories

$$\sigma = \frac{s_{34} s_{12}}{\sqrt{s_{23}}} ; \frac{\delta \sigma}{\sigma} \approx 20\%$$

b) refined solar models, supported by helioseismology, predict  $T_c$  within 0.5%

[Remind that helioseismology determines sound speed (also at solar center), not  $T_c$ ]

The central solar temperature has become an observable:

$$\boxed{\varphi_{\text{tot}}(B) \propto S_{\text{nuc}} T_c^{25}}$$

given by

SNO + SK

given by Nuc. Phys

$\approx 20\%$

$\approx 20\%$

All this gives

$$T_c \approx T_c^{\text{SSM}} (1 \pm 1\%)$$

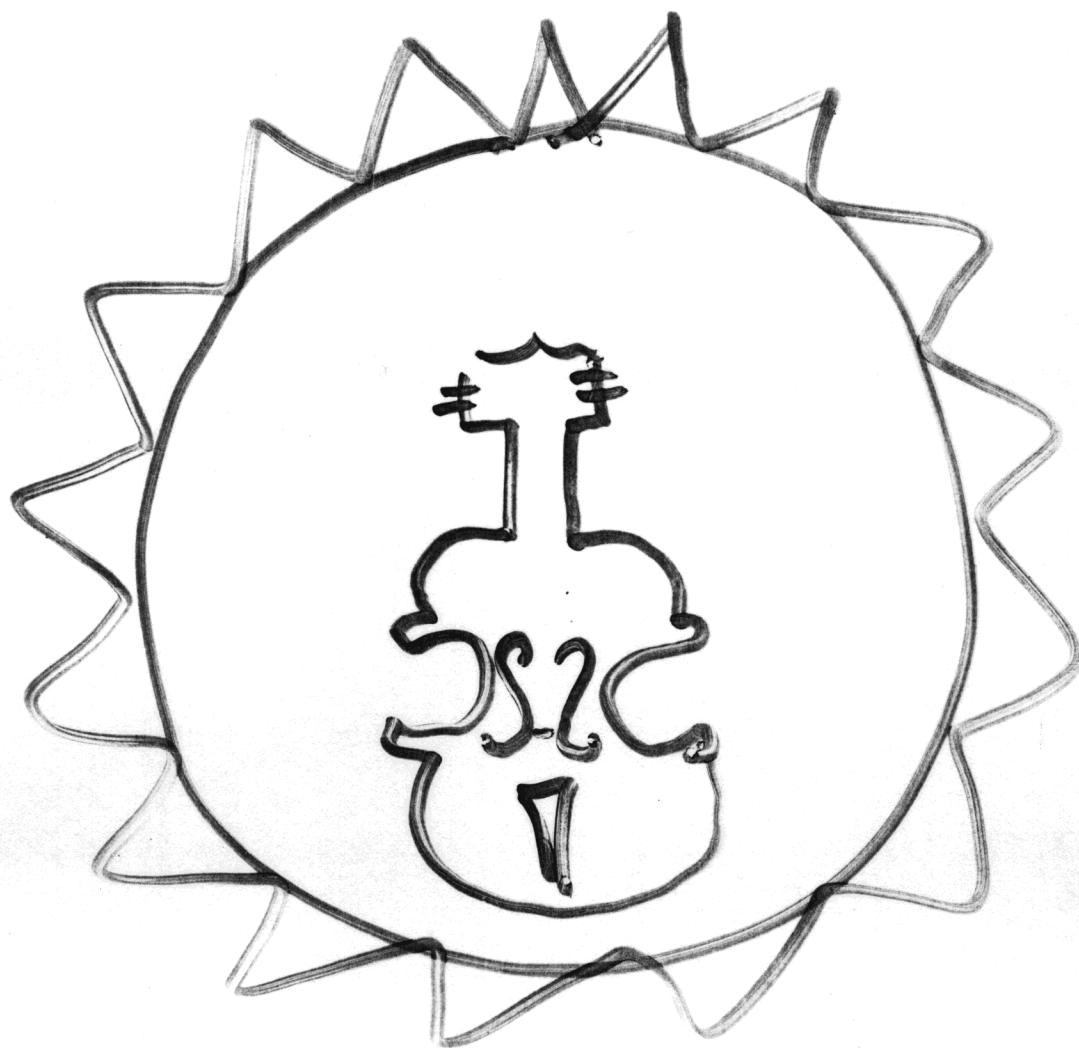
[For a comparison

$$T_c^{\oplus} = (4000 \pm 1000)^{\circ}\text{K}$$

We have now an excellent solar center thermometer

# HELIOSEISMOLOGY

(7b)



$T_{\text{travel}} \leq 5 \text{ ms}$

$T_0 \approx 5 \text{ minutes}$

## Connection with helioseismology

- Helioseismology gives sound speed near the solar center with  $\sim 1\%$  accuracy.
- From sunspot measurement of  $T_c$  can get now chemical composition (HELIUM)

$$Y_c = 0.65 \pm 0.01$$

to be compared with surface values

$$Y_{\text{phot}} \approx 0.250 \pm 0.003$$

${}^4\text{H} \rightarrow {}^4\text{He}$  transformation really occurs  
in the Sun.

18 bis.

"A pensare male  
si fa peccato,  
ma sperare si ha ragione."  
(G.A.)

To distrust is sinful,  
but helpful  
(A.M.D.)

Along decades, many (not  
(really justified) suspects have  
been advanced concerning  
the wonderful Davis experiment..

NO CLOUD ON CL EXPT !!

$$CL \sim \frac{1}{3} CL_{SSM}$$

NO SPECTRAL DEF

$$Ga \sim \frac{1}{2} Ga_{SSM}$$

+ NO DAY NIGHT

$$SK \sim \frac{1}{2} SK_{SSM}$$

NO MODULATION

Diffuse suspect and Temptation

CL expt "wrong"; make the replacement

$$\frac{1}{3} \rightarrow \frac{1}{2}$$

and get "universal oscillations"

After SNO the situation is completely different :

$$\boxed{\varphi_e(B) \sim \frac{1}{3} \varphi_e^{SSM}(B)}$$

is what comes out from SNO + SK, and is fully consistent with CL result